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ENGINEERING REPORT

on

DRAINAGE CANAL CONNECTING

MYAKKA RIVER AND ROBERTS BAY

SARASOTA COUNTY, FLORIDA

for

ALBERT E. BLACKBURN

Venice, Florida

March, 1959

DE LEUW, CATHER & BRILL

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March 18, 1959

Mr. Albert E. Blackburn
Post Office Box 1448
Venice, Florida

RE: Blackburn Canal

Dear Mr. Blackburn:

We have completed our studies on the feasibility of constructing a canal connecting the Myakka River and Roberts Bay at Venice, Florida and the benefits to be derived therefrom, and are presenting herewith our engineering report prepared in accordance with the terms of our agreement dated February 4, 1959.

The conclusions and recommendations contained in this report are based on a careful analysis of rainfall and stream gaging records for the Myakka River Basin, actual determination of high water elevations in the immediate vicinity of the proposed canal and at State Road 72, channel cross-sections of the river above and below the canal, and a field survey along the route of the partially-completed canal.

As a result of the studies we have made and summarized in this report, it is our conclusion that construction of the canal is practical from an engineering standpoint, that definite relief from periodic flooding by the Myakka River will be obtained provided the additional construction and excavation recommended herein is performed and that there will be no adverse effects to the natural resources of the Myakka River or Roberts Bay.

We appreciate the opportunity of undertaking this assignment for you and look forward to assisting you in the further development of this project.

Very truly yours,

Ben Gray

Benjamin Gray

BG::bm

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INTRODUCTION

A. Purpose of Study

The purpose of this study has been to investigate the Myakka River drainage basin and its history so as to determine whether the projected canal will offer any relief from flooding conditions, what additional construction in or adjacent to the canal might be needed to make it effective and practical, and, if such a canal is feasible, what its effect would be on adjacent land areas, including the benefits which might accrue to the surrounding territory.

B. Description of Area

The Myakka River, fed by its tributary streams, flows in a southwesterly direction from headwaters in eastern Manatee County to a point six miles northeast of Venice. From that point the river bends to the east and continues on in a southeasterly direction until it empties into Charlotte Harbor below the mouth of the Peace River at Punta Gorda. The main strand is approximately 50 miles in length from head to mouth and drains an area of about 450 square miles in Manatee, Hardee, Sarasota and Charlotte Counties. The combined Myakka and Peace Rivers are considered by the U. S. Geological Survey to be one of the major drainage basins of Florida, having a total area of approximately 2500 square miles (Exhibit I).

The Myakka is typical of the many low-gradient coastal streams of

Florida. The mouth is long, wide and shallow extending 12 miles inland from Charlotte Harbor to a point north of U. S. 41 (Tamiami Trail), and has ill-defined, marshy banks with the usual heavy growth of Mangrove and marsh grass. Beyond that point, the river is meandering and slow, comparatively narrow, and has well-defined channel and banks. Through its lower reaches the river bottom is several feet deeper than at its mouth due to scouring action during periods of high run-off. The river bottom opposite the north half of the Blackburn property in Township 39 South, Range 20 East has been found to consist of hard rock, a factor which will be discussed in more detail in a later section of this report.

Farther to the north and lying wholly within the limits of the Myakka River State Park on either side of State Road 72 connecting Sarasota and Arcadia, the river widens out to form two small lakes. Lower Myakka Lake, one mile south of the highway, is approximately 2/3 of a square mile in area with an average depth of three to four feet. A shallow earth dam has been constructed across its lower end to retain the river waters during extremely dry periods but this dam is arbitrarily broken and kept open most of the time to permit river flow. Just south of the dam and adjoining the river is a deep hole approximately 150 feet across and said to be 130 feet deep, apparently formed in the same manner as the two salt springs in southeastern Sarasota County described in Bulletin 27 of the Florida Geological Survey. There is known to be a small flow from this hole at times when the river level is below its rim. Upper Myakka Lake is 2 1/2 miles north of the highway and has an area of approximately 1 1/2 square miles. It is irregular in shape with a considerably greater storage capacity than the lower lake, having an average depth of approximately 5 1/2 feet. The lower end of the lake has a permanent concrete dam and spillway to control the lake elevation to a minimum of 13.65 compared to the approximate elevation of 10.00 in the lower lake.

C. Description of Existing Drainage Conditions

As will be pointed out later, the flat terrain and low porosity soils of the Myakka basin lead quickly to surface flooding during periods of high rainfall. This is complicated in the area between the Blackburn property and the Myakka Lakes by the fact that there are no well-defined drainage courses. During periods of extended rainfall, such as often accompany hurricanes, the already-taxed capacity of the Myakka is soon exceeded when it receives the sheet of overland runoff from this region, leading to general flooding of the lower middle river basin. This condition can be attributed further to the fact that the Myakka is tidal in dry weather almost to the north limits of the Blackburn property and that from its narrowest cross-section opposite the center of the Blackburn property, there is a rising bottom gradient to its mouth. This serves as a natural inland bottleneck to throttle the flow in the river.

Local reports indicate that there is usually some flooding at least once each year and that occasionally it will occur two or three times in a season. It is further reported that rapid rise of the river to its flood peak and return generally takes place within a 24- to 48-hour period. However, full recession of the river to its normal level is accomplished over a much longer period and drying out of the flooded lands adjacent to it may not take place in less than two to three months, with consequent heavy loss to property owners in use and productivity of the land. Apparently, a certain amount of runoff from Cow Pen Slough to the West reached the Myakka by overland flow in earlier years since recent high water marks established by the Myakka have not been as high as those recorded before construction of the canal connecting the Cow Pen with Shakett Creek and Roberts Bay.

The Blackburn property east of the Myakka River and occupying all of Township 39 South, Range 20 East north of Tamiami Trail has borne the brunt of much of the frequent flooding. The land is used primarily for grazing and has been grubbed and planted with Pensacola Bahia grass in several areas. In an attempt to divert some of the overland flow from the north, a shallow ditch and dike have been constructed along the western two-thirds of the north property line. These serve the purpose until such time as the river floods and the dike height is exceeded by flood waters. Of course, there is always a certain amount of direct flooding from the river when it exceeds its banks adjacent to the property.

To relieve the usual periodic flooding, Mr. Blackburn conceived the idea and secured the rights-of-way for a canal connecting the Myakka River and Roberts Bay along the route of an old drainage ditch that emptied into

Curry Creek and thence into the Bay. A substantial portion of the construction of this canal was accomplished before the question arose as to the actual results to be obtained from such a canal and the effects it would have on the surrounding area.

D. Scope of Investigations

Inasmuch as there is no local authority having direct regulatory powers over drainage construction in Sarasota County, a meeting of all interested local, state and federal officials was convened in Venice on January 7, 1959 to discuss the matter in more detail. It was determined at that time that, prior to the completion of the canal, a comprehensive investigation and report on the Myakka River problem should be made by a qualified firm of engineering consultants. Subsequent to the meeting, Mr. Blackburn retained this firm to make such a study.

As a first step in evaluation of the problems involved, a field inspection of the site was made by engineers of this firm for familiarization and orientation purposes (Exhibit II). This included an inspection of the canal route from its junction with the Myakka River to its ending at Roberts Bay. In addition, the Blackburn property east of the river was inspected and visual observations of the Myakka River at several points between U. S. 41 and State Road 72 were made.

Inquiries of people living or working along the river were made to determine observed past flood conditions and the extent and duration of severe floods and runoff. From these inquiries, it was possible to obtain a general picture of the peak flood characteristics of the river at several locations.

Field surveys were then made along the route of the canal and at several locations in the Myakka basin to obtain information needed in the engineering analysis. A topographical survey of the canal was made between the Venice By-Way and the Myakka River and cross-sections of the canal were taken at intervals of 500 feet. The elevations and location of all roads, bridges, ditches, and streams intersecting or intercepted by the canal were obtained (Exhibit III). Profiles across the Myakka River drainage basin from the western to eastern limits were taken at points 3/4-mile north of the canal and 3 1/2 miles south of the canal. Cross-sections of the Myakka River were obtained at these two locations, at the canal itself, at a point one mile south of the canal, and at a point ten miles north at State Road 72. Soundings were taken in the river above and below the canal and in both the Lower and Upper Myakka Lakes. Finally, high water elevations were established at the northern limits of the Blackburn property and at State Road 72 (Exhibit IV).

Extensive research into hydrological and geological data gathered by various local, state, and governmental agencies was made to secure remaining information needed. This included stream gaging records for the Myakka River compiled by the U. S. Geological Survey, rainfall records of the U. S. Weather Bureau, geological data prepared by the Florida

Geological Survey, tide tables published by the U. S. Coast and Geodetic Survey, and various other reports and bulletins including the very helpful report on Florida's Water Resources prepared in 1957 by the Florida Water Resources Study Commission.

ENGINEERING STUDIES

The engineering studies undertaken during the preparation of this report include a survey of the geology of the area as related to surface run-off, basic investigations to determine alternate drainage schemes and, finally, the design considerations for the recommended solution.

A. Geology and Soils

The soils in Sarasota County have recently been mapped by the University of Florida Agricultural Experiment Station in cooperation with the U. S. Department of Agriculture but the published report on this study is not yet available. Although there is some disagreement among geologists as to the classification of formations underlying the Pamlico sands, our own research indicates that in the vicinity of the Blackburn Canal the general description is as shown in Exhibit V.

Geology for the area is covered in some detail in Bulletins 27 and 29 of the Florida Geological Survey. Briefly, it might be stated that the Florida peninsula is made up entirely of sedimentary deposits of a marine or estuarine nature laid up over the geologic ages by cyclical changes in the elevation of the sea coupled, in later stages, with some folding or tilting of the earth's surface. Surficial deposits (Exhibit V) in the lower portion of the Myakka basin are generally Pamlico quartz sands of the late Pleistocene Series merging into Talbot sands of an earlier stage in the upper reaches of the river. Between the coast and the river the sands overlie an earlier Pleistocene deposit of shell marl from the Anastasia formation possibly intermingled with deposits of the much older Caloosahatchee Marl from the Pliocene series known to exist east of the river. The central portion of the basin is underlain by an exposed portion of the Hawthorne formation of the Miocene Series, a sandy phosphatic limestone, which is only exceeded in geologic age in Florida by the Tampa and Ocala limestone deposits. It is believed that the rock bottom in the Myakka mentioned earlier is a hard lens of this formation. The headwaters of the Myakka, north of the lakes, drain a portion of a large area of phosphatic sand, clay and gravel attributed to the Bone Valley formation of the late Pliocene Series.

The terrain in that portion of Sarasota County traversed by the Myakka does not lend itself readily to proper drainage. The land is flat to gently sloping, extensively spotted with shallow depressions, ponds and sloughs which quickly fill with water during heavy rains due to the low porosity of the underlying shell marls, and is variously overgrown with palmetto, pine, cypress and oak except for those areas west of the Myakka which have been cleared for farming. There are a few streams, pseudostreams and ditches draining the southeastern part of the county into the river in the vicinity of the Tamiami Trail but well-defined drainage from east of Venice to the Myakka Lakes is non-existent. When all the ponds and depressions become full, area drainage is achieved by overland flow. The western boundary of the Myakka basin is a line roughly one to two miles from and paralleling the river from its mouth to State Road 72. From that point, it flares 3 or 4 more miles away from the river to include the tributary streams draining the uplands of eastern Sarasota and Manatee Counties. The eastern boundary is not quite so definite but generally splits the plateau between the Myakka and Peace Rivers. North of State Road 72 it closely follows the east Manatee County line.

B. Basic Investigations

On first examination, two alternates to the Blackburn Canal for relieving flood conditions on the Myakka River offer themselves.

First would be the general straightening and deepening of the Myakka from its mouth to Lower Myakka Lake, and second would be the excavation of a canal linking the Myakka and Cow Pen Slough northeast of Venice with Shakett Creek and Dona Bay.

The first of these, though a good solution, has been discarded because of its obviously prohibitive cost, particularly through sections where rock would be encountered, and also because of the extensive damage which would result to the natural beauty of the river.

The second alternate is a desirable solution, but would result in high maintenance costs because control structures would be necessary to prevent overdrainage. The Blackburn Canal offers the possibility of flood relief without expensive control structures.

All information gathered for this study indicates that the basic problem to be considered at this time is the positive relief of excess runoff into the Myakka River during periods of extreme rainfall. At some future date the conservation of this runoff for human consumption by utilizing the Myakka Lakes and the area between them for reservoir storage may become necessary, thus adding greatly to the facilities for flood control. Such a possibility, however, has not been taken into consideration in the following hydraulic analysis.

In determining the amount of relief to be provided, it has been concluded that the maximum capacity of the existing Myakka Channel opposite the Blackburn property should be utilized so as to keep the canal construction costs to a minimum. This may mean some spot flooding of low bank areas along the river and at tributary entrances.

C. Watershed Area and Runoff

Stream gaging information has been obtained for many years at a station located just below the Upper Myakka Lake. This station records the flow for a 235-square-mile section of the upper Myakka watershed. A maximum flow of 6,620 c.f.s. was recorded in 1947 and the minimum and average flow for the past 20 years are 0 and 244 c.f.s., respectively.

In comparison, the maximum flow in 1956 was 826 c.f.s.

The additional watershed area between the entrance to the Blackburn Canal and the gaging station amounts to approximately 65 square miles for a total watershed of 300 square miles. The equivalent discharge at the canal would then be 8,500 c.f.s. For design purposes, this has been arbitrarily reduced to 8,000 c.f.s., taking into consideration the storage capacity of Lower Myakka Lake and its probable leveling effect on the flow. An even greater reduction could probably be expected but this was not considered advisable. In design of the canal proper, an additional 250 c.f.s. has been anticipated from areas adjoining the canal.

As a further check on the above, the following analysis of rainfall records was made:

According to the Rainfall Intensity-Duration-Frequency Curves for Tampa, Florida (U. S. Department of Commerce, Weather Bureau, Technical Paper No. 25), the maximum precipitation in 24 hours for a 25-year storm would be $0.31 \times 24 = 7.5$ in. Using a runoff coefficient of $n = 0.1$ the total runoff to reach the river at the end of 24 hours would be

$$Q = \frac{(5280)^2 \times 300 \times 7.5 \times 0.1}{86,400 \times 12} = 6,050 \text{ c.f.s.}$$

Although greater intensities of rainfall occur during short intervals of time, the maximum intensity is taken as based upon a 24-hour storm duration, in order to allow for time of concentration at the river location. Carrying this one step further, the selected design discharge of 8,500 c.f.s.

is roughly equivalent to that which might be expected once in 50 years.

D. Design Flow in the Myakka River

Cross-sections of the Myakka River channel were taken at five locations (Exhibit IV). At Crossing No. 1 and Crossing No. 2, high water elevations were established. Assuming an actual channel length of 18 miles for the 9 miles between these two points, there is a bottom gradient of

$$S = \frac{5 - (-7.5)}{18} = 0.69 \text{ ft./mile}$$

Assuming that recorded high waters for these two points occur at the same time, the water surface gradient for this reach would be

$$S = \frac{18.7 - 11.6}{18} = 0.39 \text{ ft./mile}$$

The probability that such a simultaneous peak would occur, however, seems unlikely.

The following analysis of the Myakka channel at each of the crossings indicates the actual hydraulic requirements in order for the channel to handle the design discharge.

(1) State Road 72 - At high water elevation of 18.7, the channel area is 2,100 sq. ft. At the expected discharge of 6,620 c.f.s. the velocity would be 3.13 ft./sec.

(2) Blackburn Bridge (North property line) - At an elevation of 10.0 (1.6 feet below known high water line) when the river starts to leave its banks, the channel cross-section is 2,100 sq. ft. For a discharge of 8,000 c.f.s. the

average velocity would be 3.75 ft./sec. The required energy gradient would be

$$S = \left(\frac{Q\,n}{1.486\ A\ R\ 2/3}\right)^2 = \left(\frac{8,000\ (0.03)}{1.486 \times 2,100 \times 5.0}\right)^2 = 0.00023$$

or 1.2 ft./mi.

For uniform flow between the above two points, assuming a constant channel cross-section and an average discharge Q = 7,310 c.f.s., the slope of the required energy gradient is

$$S = \left(\frac{7,310\ (0.03)}{1.486 \times 2,100 \times 4.64}\right)^2 \times 5,280 = 1.2 \text{ ft./mi.}$$

From a comparison of the computed bottom gradient and the required energy gradient, it is apparent that a backwater condition exists from the Blackburn property north to Lower Myakka Lake.

The following summarizes the hydraulic conditions at the canal mouth and below.

TABLE I

	Crossing	Bottom El.	Assumed Water El.	Area Sq.Ft.	Q c.f.s.	V ft./sec.	S ft./mi.
(3)	Blackburn Canal	-6.7	8.0	1,400	8,000	5.7	3.76
(4)	Venice Road	-7.0	8.0	1,370	8,000	5.7	3.76
(5)	4 Miles South of (3)	-3.0	3.0	2,920	8,000	2.8	1.6

It is evident that definite throttling of the Myakka flow occurs between the Blackburn Canal and Venice Road. The elevation of 8.00 at the Blackburn

Canal is the elevation which would be necessary to prevent flooding of the adjacent land. Crossing No. (5) shows a definite change in flow conditions. The river bed here widens out considerably and the water level is not influenced so much by flood waters and high discharge as it is by tide action from Charlotte Harbor. In order to handle the design discharge at normal high tide conditions with the required energy gradient, the water elevation at this point should not exceed 4.5 ft.

E. Canal Design

In order for the river to stay within its banks at the entrance to the Blackburn Canal, the known high water level must be reduced approximately three feet. The proposed canal is at the last strategic point for offering this relief.

On the assumption that the river elevation should be reduced 3 feet, it was decided that a canal cross-sectional area should be selected that would equal, as nearly as possible, the reduction in cross-sectional area of the river without requiring any more additional canal excavation than necessary. At the mouth of the canal, such a river area would be approximately 150 x 3 = 450 sq. ft. Limiting the canal entrance velocity to 1.75 ft./sec. indicates a canal design discharge, Q = 800 c.f.s. Although this is only 10% of the maximum river discharge, it will be an extremely important factor in lowering the river level at peak discharge. As will be shown later, the increase in discharge of the canal as the water level rises is almost in proportion to the third power of the depth.

From the field survey notes a plan and profile for the six-mile length of the canal were plotted (Exhibit III). Canal cross-sections were plotted and studied for the most economical section meeting the above criteria. These sections were later used for computing final earthwork quantities.

The controlling water level at Roberts Bay was taken to be 1.6, the expected high tide. The effects of high flood or hurricane tides were not considered, as this condition cannot be provided for in a feasible program. The channel section at the lower end is controlled by the existing Venice By-Way bridge, a pre-cast reinforced concrete structure of 60-foot span, having a pre-cast pile center pier. By trial, a section of 45 feet bottom width, 2 on 1 side slopes, and a depth of 7 feet was selected as being satisfactory. With a design discharge, Q, at this point of $800 + 250 = 1,050$ c.f.s., the energy gradient by the Manning Formula, using $n = 0.030$ for large canals with straight banks in fair condition, is $S \doteq 0.00025$. The average velocity would be $V = 2.50$ ft./sec. This would be within the range of 2.00 - 3.00 ft./sec. established as a permissable, non-scouring canal velocity in non-colloidal, silty or sandy loams by the Special Committee on Irrigation Research, Transactions, American Society of Civil Engineers, 1926. The shell marl generally encountered along the reach of the canal could probably be compared to non-colloidal graded, loam to cobbles with a maximum permissable velocity of 5.00 ft./sec.

The natural ground starts rising away from the Curry Creek flood plain approximately one mile east of the Venice By-Way. At this point the canal bottom width is reduced from 45 feet to 30 feet so as to achieve a hydraulically more efficient section and also so as to approximate the already completed excavation. Trial solutions further indicate that such a section approximates the required area at the Myakka River and gives the desired gradient.

With the bottom elevation of the canal established at each end, a grade line was drawn, following closely the completed portion of the canal, and computations for the backwater curve were made and plotted (Table II) Manning's formula $Q = A \times \frac{1.486}{n} R^{2/3} S^{1/2}$ transposed in the form $Q = \frac{K}{n} D^{8/3} S^{1/2}$ for trapezoidal open channels (King, Handbook of Hydraulics) was used throughout. In the latter formula, K, taken from tables in King's handbook, is a factor depending upon the $\frac{D}{b}$ ratio, where D is the depth of water and b the bottom width of the channel.

CONCLUSIONS

A. Hydraulic Effect of the Canal

The highest effect of the canal will be produced during the period when the water level is rising and the slope consequently increases. It can be assumed that during times of average flow in the river

$$Q = \frac{244 \times 300}{235} = 312 \text{ c.f.s.},$$

the corresponding water level will be approximately 3.00 and the canal

TABLE II

STATION FROM	STATION TO	SECTION L'GTH IN FEET	AVERAGE Q	Qn	b	AVERAGE DEPTH IN FEET	$D^{8/3}$	K *	HYDRAULIC GRADIENT S	$S^{1/2}$	ELEVATION DIFFERENCE	HIGH WATER ELEVATION: LOW ELEVATION	HIGH WATER ELEVATION: UPPER ELEVATION	CANAL BOTTOM ELEVATION: LOW ELEVATION	CANAL BOTTOM ELEVATION: UPPER ELEVATION	MAXIMUM VELOCITY
0+00	50+00	5000	1050	31.5	45	7.22	194	10.29	0.00025	0.0158	1.25	2.00	3.25	-5.00	-4.20	2.4
50+00	100+00	5000	990	30	45/30	7.78	238	6.87	0.00033	0.0182	1.65	3.25	4.90	-4.20	-3.20	2.8
100+00	150+00	5000	833	25	30	8.10	265	6.67	0.00020	0.0142	1.00	4.90	5.90	-3.20	-2.20	2.2
150+00	200+00	5000	800	24	30	8.35	286	6.52	0.00017	0.0129	0.83	5.90	6.73	-2.20	-1.87	2.1
200+00	250+00	5000	800	24	30	8.69	318	6.38	0.00014	0.0118	0.70	6.73	7.43	-1.87	-1.34	1.9
250+00	301+50	5150	800	24	30	8.92	342	6.20	0.00013	0.0113	0.66	7.43	8.09	-1.34	-1.00	1.9

$Q = \frac{K}{n} D^{8/3} S^{1/2}$: $S^{1/2} = \frac{Qn}{KD^{8/3}}$: n IS ASSUMED 0.030 : Q IS IN C.F.S.

* TAKEN FROM TABLES, HORACE W. KING HANDBOOK OF HYDRAULICS

BACKWATER CURVE COMPUTATIONS

DE LEUW, CATHER & BRILL
ENGINEERS — ARCHITECTS

discharge will not exceed about 80 c.f.s. At an elevation of 2.00 or less there will be no significant flow except that caused by tidal fluctuations. As flood stage approaches and the elevation of 5.00 is reached, the discharge of the canal rises quickly, almost directly in proportion to the third power of the depth. When the river elevation reaches 8.00 and the canal discharge is 800 c.f.s., a certain balance should take place between the approaching masses of flood water and the total discharges of the canal and river.

Referring to Table II the entrance velocity at design discharge is 1.9 ft./sec. and the maximum velocity in the canal is 2.8 ft./sec. Even if the river elevation should rise to 9.00 with a resultant canal discharge of 1300 c.f.s., the entrance velocity would only reach 2.6 ft./sec., offering no threat of dangerous erosion. The event of any extended discharge at the latter rate seems unlikely.

The canal discharge will empty into Roberts Bay approximately one-half mile east of the U. S. 41 bridge. Velocities which would cause damage are not anticipated here under any conditions and, as reported earlier from local observations along the river, the peak discharge period should not exceed 24 to 48 hours.

B. Construction Work Remaining

Between the Venice By-Way and Roberts Bay no excavation work has been done. To ensure unimpeded flow for the last one-third mile to the bay, the existing Curry Creek channel should be widened and straightened to a minimum bottom width of 45 feet at Venice By-Way and flared gradually to 60 feet at the Bay.

From Venice By-Way to Station 50+00 the present approximate bottom width of 30 feet should be widened to 45 feet to the profile shown on Exhibit IV and the channel bottom cleaned out to the proper elevation. From Station 50+00 to Station 140+00 there is some bottom excavation and side shaping to be done. Between Station 140+00 and Station 235+00, where excavation is under way, there is a considerable amount of work to be done. Excavation is complete from the latter point to the Myakka River. There is no need for concern about the over-excavation which has occurred in some stretches as gradual silting can be expected to fill in such holes. Following is a tabulation of excavation work remaining:

TABLE III

Station		Amount, C. Y.
Roberts Bay to 0+00		Not determined
0 + 00 to 50+00		50,100
50 + 00 to 120+00		56,400
120+00 to 140+00		9,100
140+00 to 210+00		102,800
210 + 00 to 233+00 *		30,900
	TOTAL	249,300

* Havana Road

The approximate amount of material already excavated has been computed to be 412,000 C. Y. This does not take into consideration the creek or ditch section already existing when excavation began and, therefore, is undoubtedly on the high side.

To protect and control the size of the canal entrance at the Myakka River, sheet piling should be installed on each side of the entrance as shown on Exhibit VI. An alternate design for either steel or prestressed concrete sheeting is shown on Exhibit VII. From knowledge of the underlying rock, it is doubtful whether concrete piling could be used without pre-punching. Such an option could, however, be offered for bidding.

To prevent overdrainage of the areas adjacent to the canal and to eliminate the probability of erosion at low canal stages, culverts and flumes of adequate size should be installed at each ditch or stream emptying into the canal.

C. <u>Controversial Features</u>

The question of diversion of fresh water to Roberts Bay has been touched on briefly in an earlier section. It was shown at that time that the velocity and amount of water to be diverted would peak over a relatively short period of time. Inasmuch as the average Myakka flow sends a relatively insignificant amount of water through the canal, the peaks which occur once, and at the most, two or three times a year would not adversely affect the Myakka River and Roberts Bay.

As previously indicated under the heading "Description of Area", the

Myakka River may run dry during an average period of two months in a year. Depending on the level of the tides, water from the Gulf of Mexico will back up into the river bed to a point which rarely reaches as far north as the location of the proposed canal. Surface runoff water which remains in the river is actually ponded by the denser salt water, with the result that the entire river becomes subject to tidal action. Consequently, the water in the proposed canal would seldom be salty. In order to insure the continued satisfactory performance of potable well water supplies adjacent to the canal, an investigation was made to determine the possibility of salt water intrusion under the deliberately adverse assumption that the canal will contain salt water over an extended period of time. A review of the existing wells in the area indicates that the preponderance of wells tap an artesian aquifer located at a depth in excess of 300 feet below ground. From the geology of the area, it is evident that water in this aquifer is in no way related to the surface water table, nor could there be any physical connection by the very nature of the supply being artesian. Thus, if the entire surface of the area were flooded with salt water, the quality of water obtained from such artesian wells would in no way be affected. A relatively small number of irrigation wells tap an aquifer within the comparatively shallow phosphatic limestone formation. Although this water is non-artesian, the surface "Aquaclude" layer, which is impervious to water, prevents penetration of surface flows to the lower strata.

It may be stated therefore that there is every reason to expect the existing wells to function as satisfactorily after the completion of the canal as they do at the present time .

D. Benefits to the Area

It would be impossible to assess the monetary value accruing to the south central portion of Sarasota County from the elimination of periodic flooding along the Myakka River. A summation of the property losses resulting over the past decade would only present a small part of the picture as many thousands of acres have never been productively developed to their full usefulness because of the lack of drainage and the threat of annual overflow. Many hundreds of acres of crops have been lost in the past, due, if not directly to flooding, to the poor runoff induced by the flooded lowlands. With the completion of the Blackburn Canal and the construction of a systematic pattern of drainage ditches in presently undrained sections, a whole new area will be available for development and existing developed areas can be better utilized. This will profit not only the property owners riparian to the canal and river but the present and future populations of Sarasota County as well.

The canal will also open an exciting new avenue of interest to boatmen along the Gulf Coast. With completion of an intercoastal waterway connecting Sarasota and Venice with Lemon Bay, a varied course of salt water fishing and cruising can be exchanged in a matter of minutes for a trip up an extremely picturesque fresh water stream, and navigational potentialities on the Myakka River will be improved with a corresponding increase in property values.

An indirect benefit in constructing the canal is its usefulness as part of a network in the possible future development of the river as a reservoir for water from surface runoff. Being derived from rainfall, the surface runoff water found in the Myakka River has a low mineral content. Instead of permitting such water to flow freely into the Gulf of Mexico, it can be ponded by installing removable tide gates in the river just south of the proposed canal and in the canal itself, and providing suitable additional reservoir capacity for control of overall river discharge. With a minimum of controls, such a system will be able to handle the excess water available during period of peak flow to prevent flooding of adjacent areas. Because of the large volumetric capacity of the river channel, and its associated lakes and canals, its development as a source of potable water will be of future importance to the area.

RECOMMENDATIONS

On the basis of the studies and conclusions reached in this report, it is recommended that:

1. The Blackburn Canal be constructed along the alignment and to the profile and cross-sections shown on Exhibits III and IV.

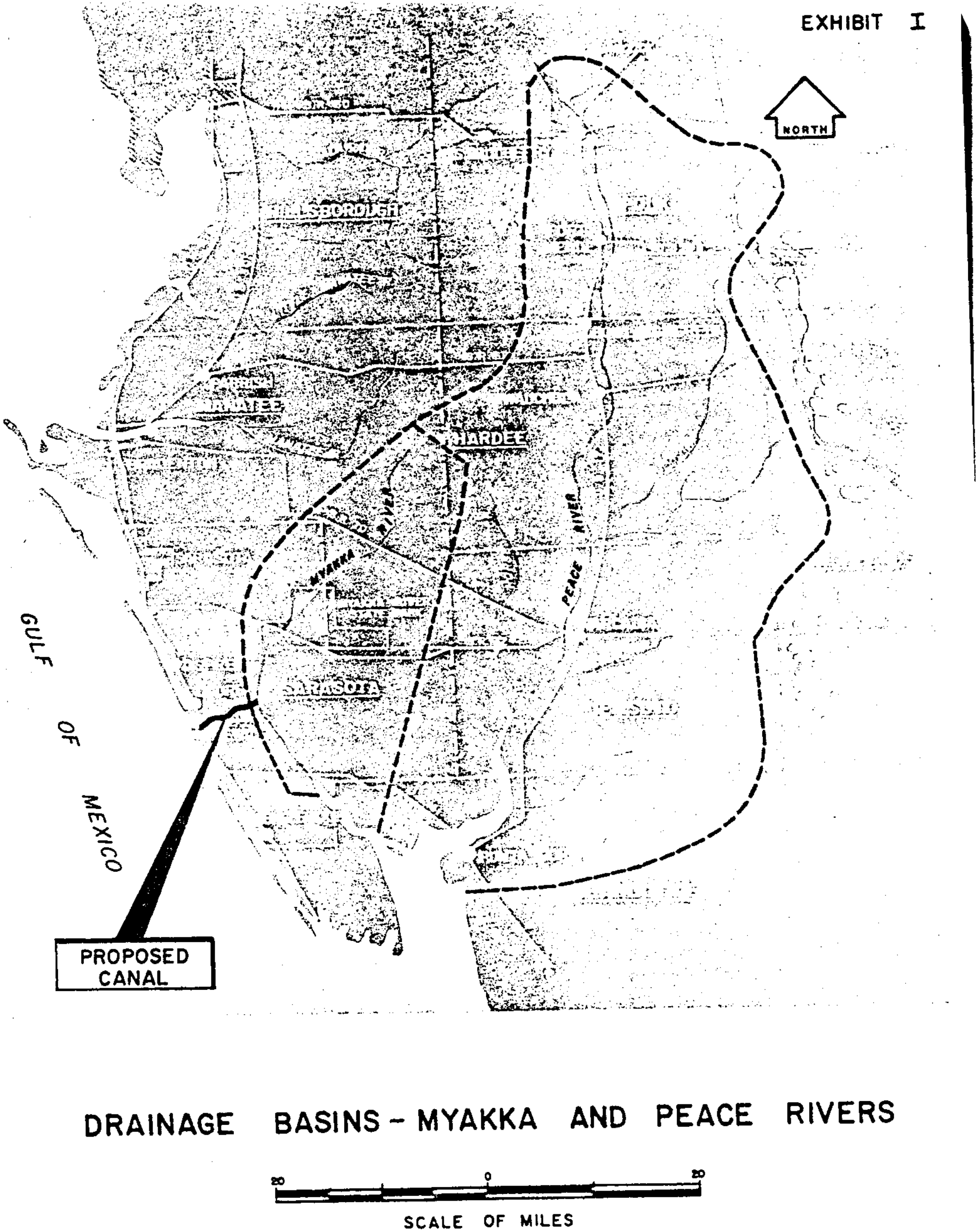
2. The Curry Creek channel between the Venice By-Way and Roberts

Bay should be widened and straightened to a bottom width of 45 feet at Venice By-Way and gradually flared to a width of 60 feet at Roberts Bay.

3. Culverts of adequate size, capped with compacted earth backfill, and concrete flumes or spillways of proper shape extending to mean low water level in the canal, should be installed at each ditch or stream emptying into the canal.

4. Prestressed concrete or steel sheet piling as shown on Exhibits VI and VII should be installed at the entrance to the canal from the Myakka River.

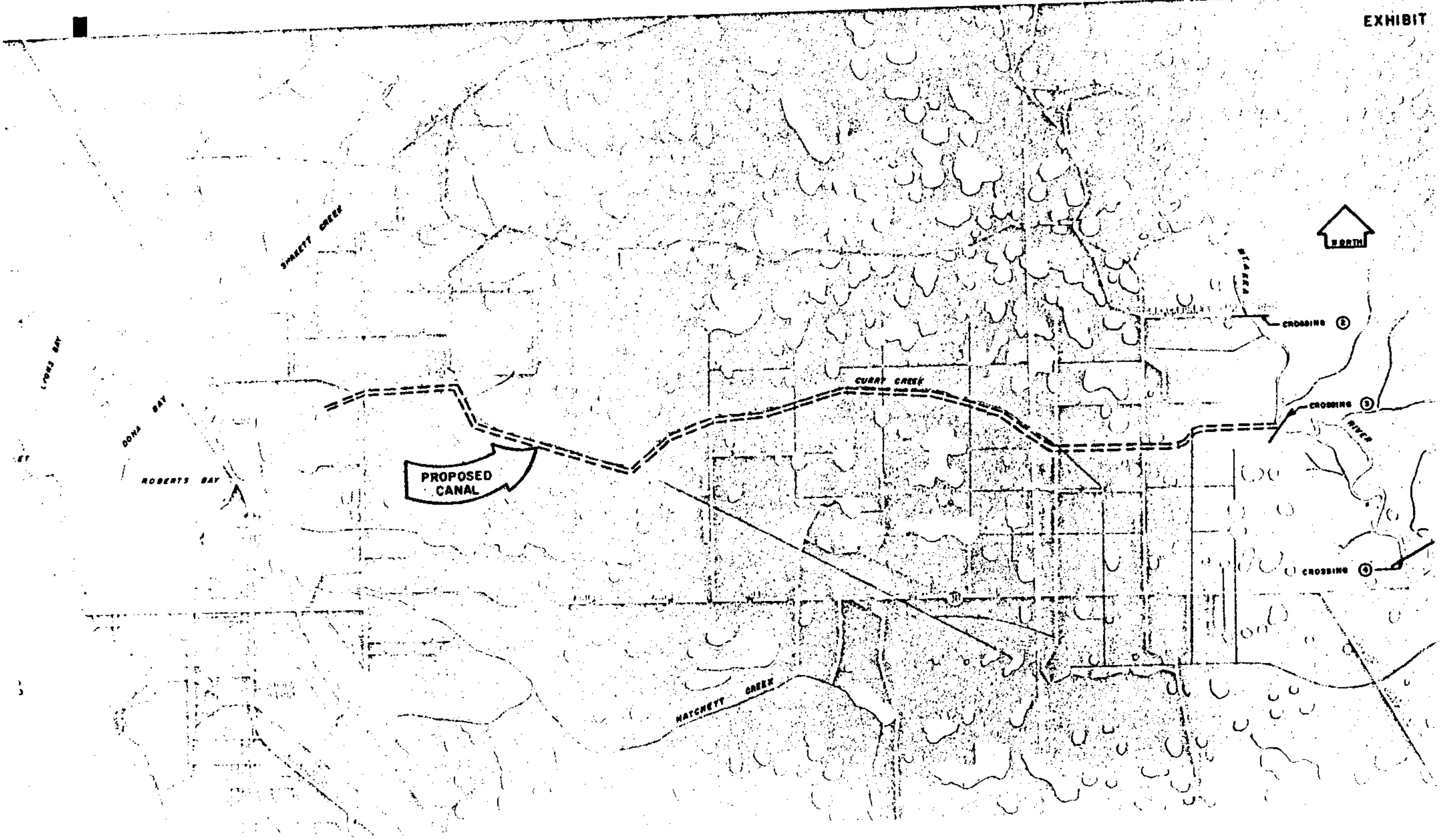
5. Reinforced concrete bridges, similar to that at Auburn Road, should be constructed over the canal at Havana and Jackson Road.



DRAINAGE BASINS - MYAKKA AND PEACE RIVERS

DE LEUW, CATHER & BRILL
ENGINEERS - ARCHITECTS

EXHIBIT

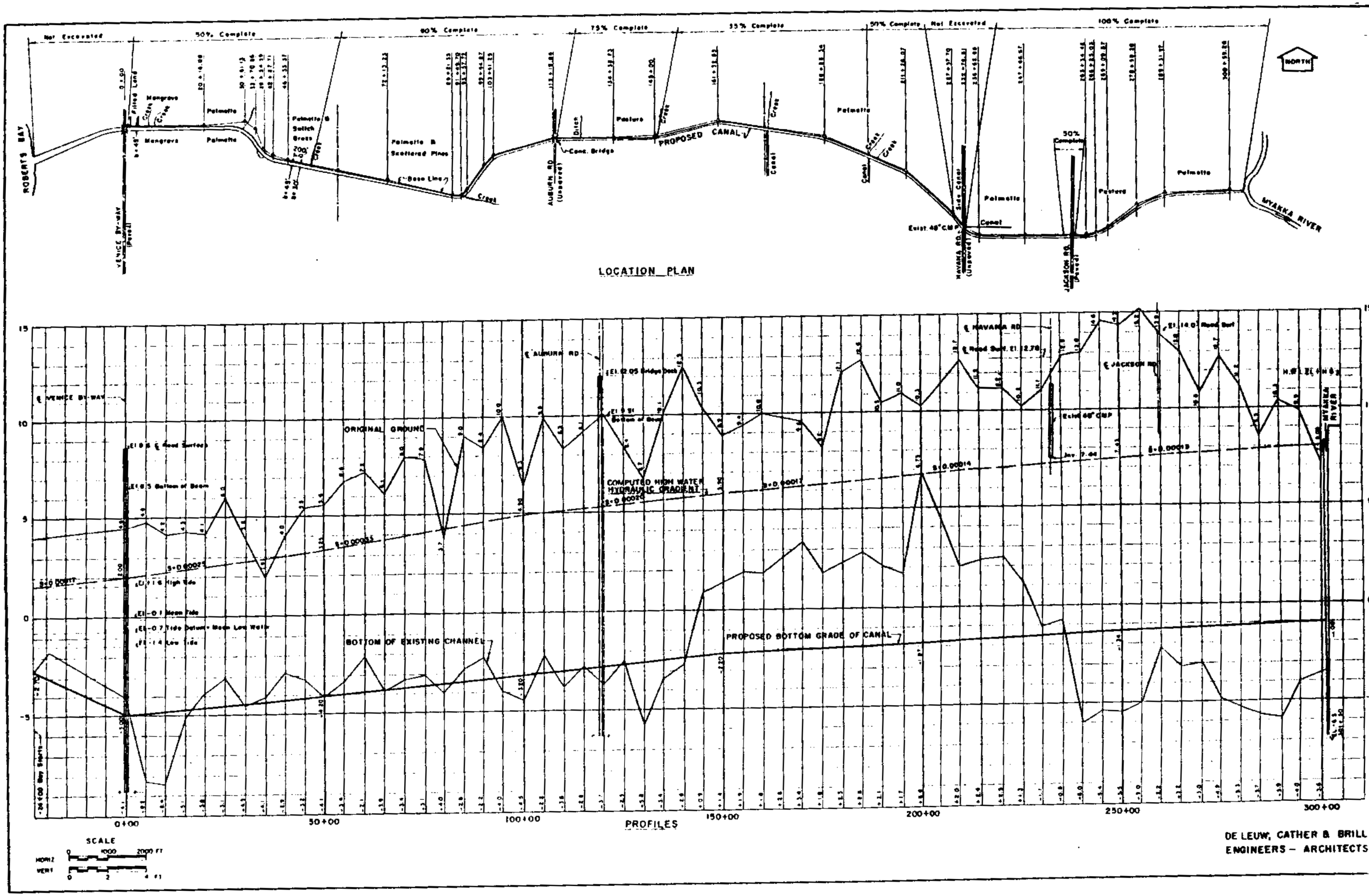


LOCATION MAP

SCALE: 1" = ONE-HALF MILE

DE LEUW, CATHER (
ENGINEERS — ARC

EXHIBIT III



DE LEUW, CATHER & BRILL
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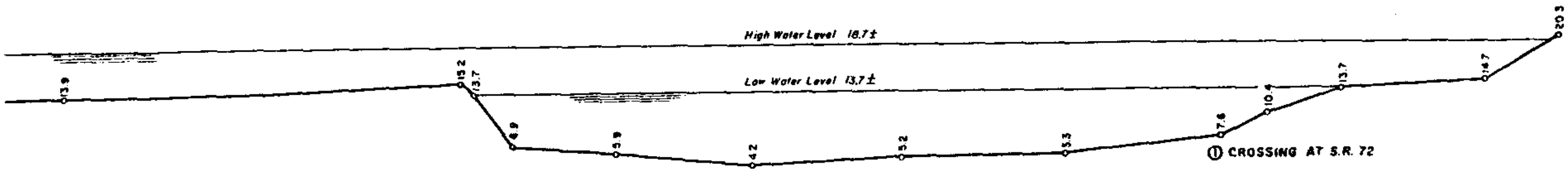
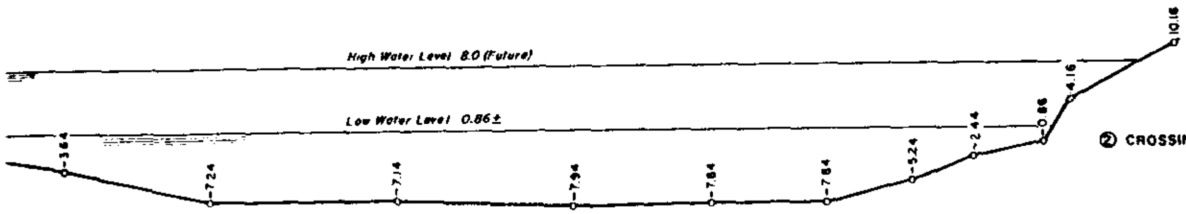
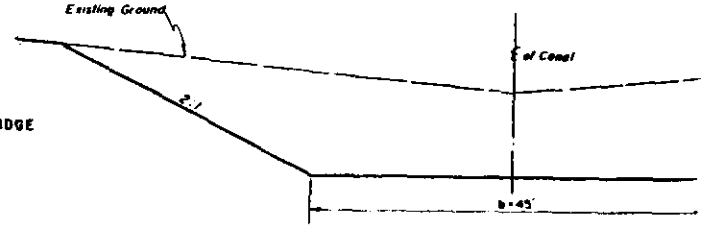


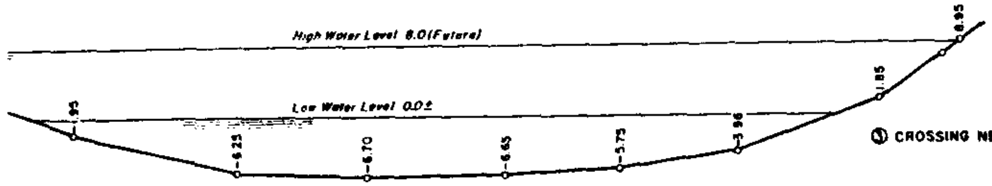
① CROSSING AT S.R. 72



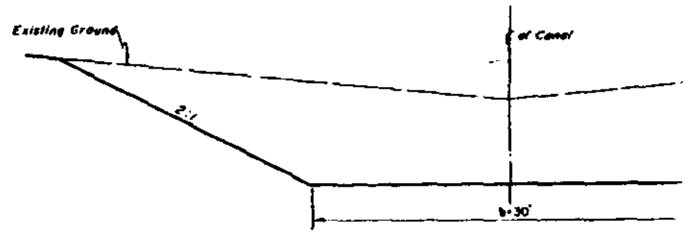
② CROSSING AT BLACKBURN BRIDGE



SECTION FROM STA.0+0 TO STA.48+00



③ CROSSING NEAR PROPOSED BLACKBURN CANAL



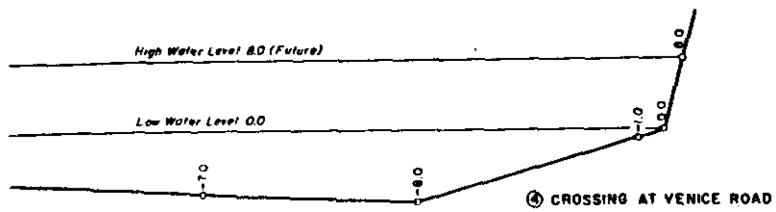
SECTION FROM STA.50+00 TO STA.301+5

TYPICAL CANAL SECTIONS

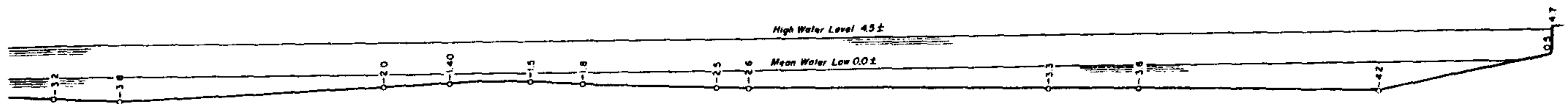
TABLE OF AREAS AND PERIMETERS

CROSSING NUMBER	HIGH WATER AREA	HIGH WATER WETTED PERIM.	LOW WATER AREA	LOW WATER WETTED PERIM.	0.0 WATER AREA	0.0 WATER WETTED PERIM.
1	2115	223	850	122	—	—
2	1810	175	880	160	780	150
3	1400	155	440	100	440	100
4	1374	127	550	110	550	110
5	4200	1000	—	—	1370	516

AREA IN SQUARE FEET
WETTED PERIM IN FEET



④ CROSSING AT VENICE ROAD

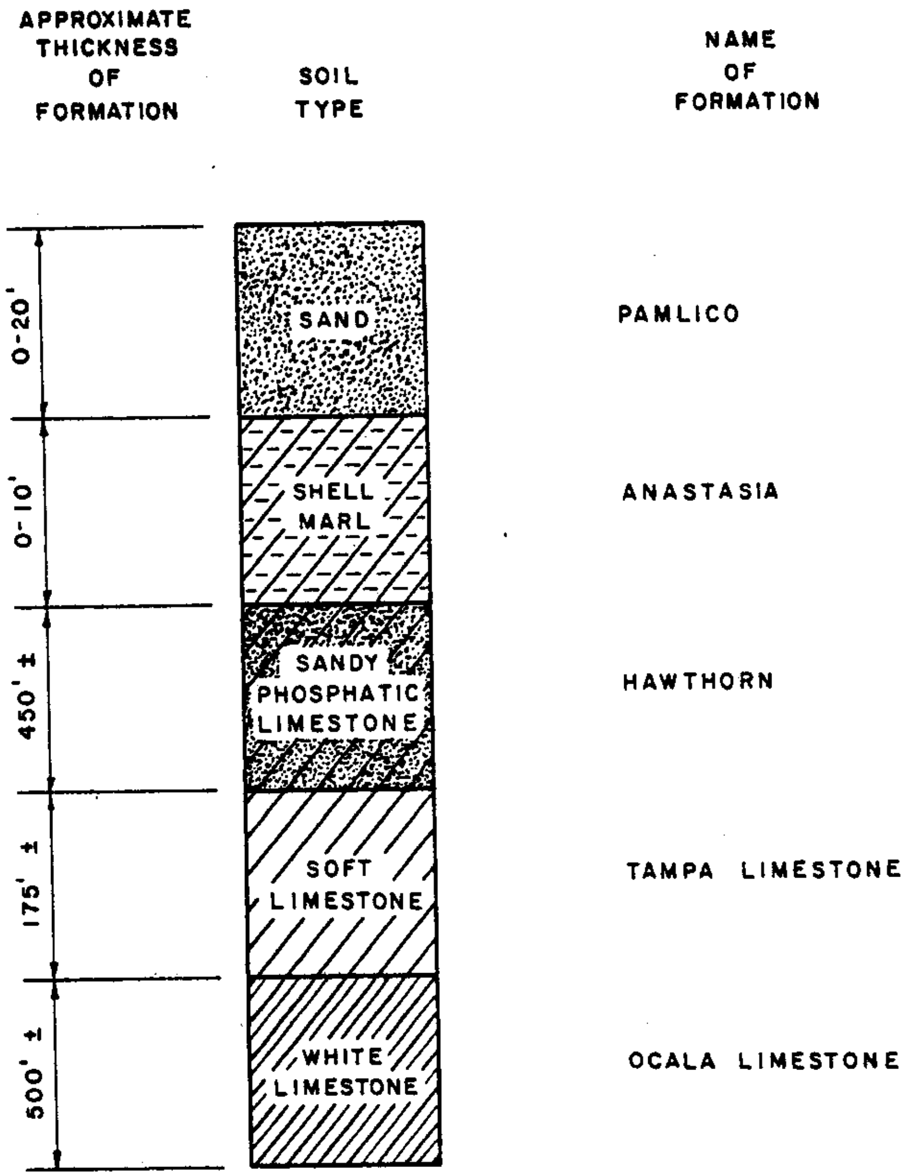


⑤ CROSSING AT 4 MILES SOUTH OF BLACKBURN CANAL

CROSS SECTIONS OF MYAKKA RIVER

SCALE FOR CROSSINGS ① TO ④
HORIZ. 0 10 20 FEET
VERT. 0 10 20 FEET

SCALE FOR CROSSING ⑤
HORIZ. 0 20 40 FEET
VERT. 0 10 20 FEET



GEOLOGICAL SOIL FORMATIONS

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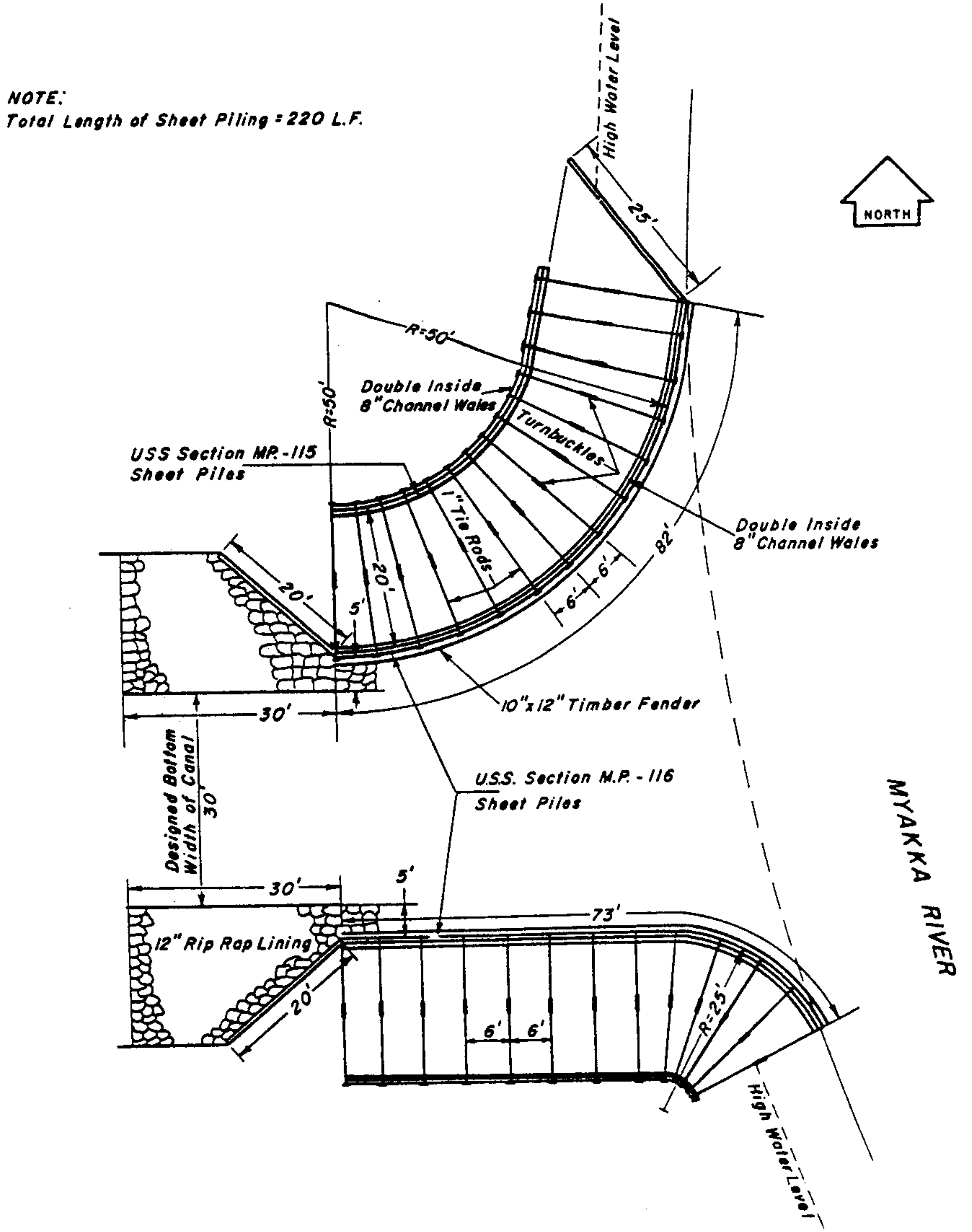

PLAN OF SHEET PILING BULKHEADS

SCALE: 1" = 20'

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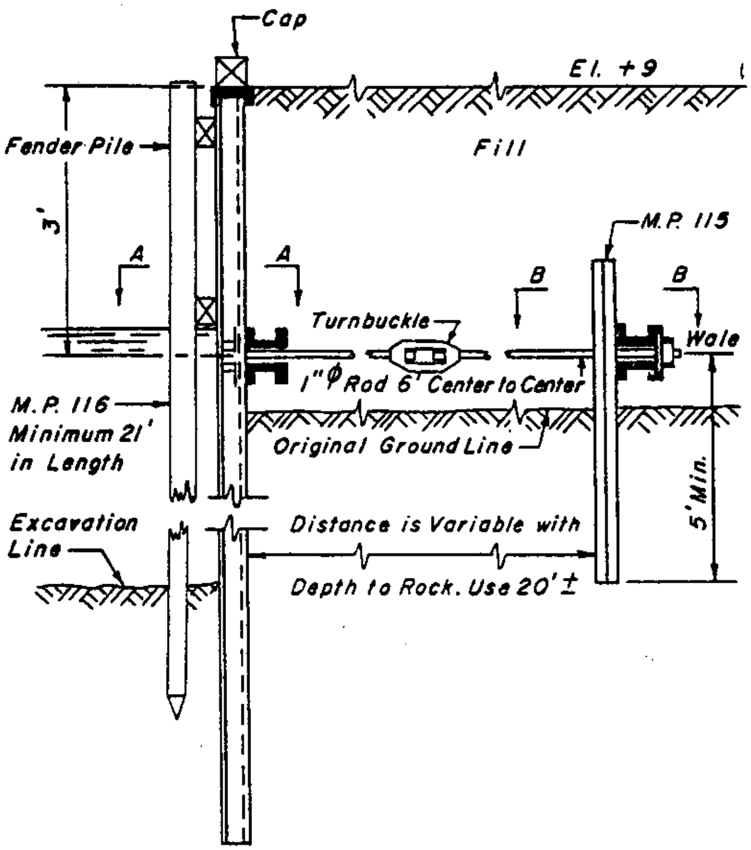
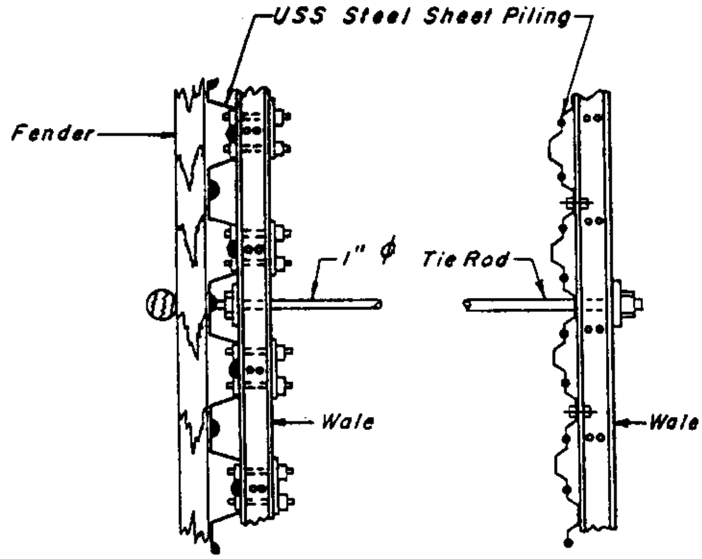
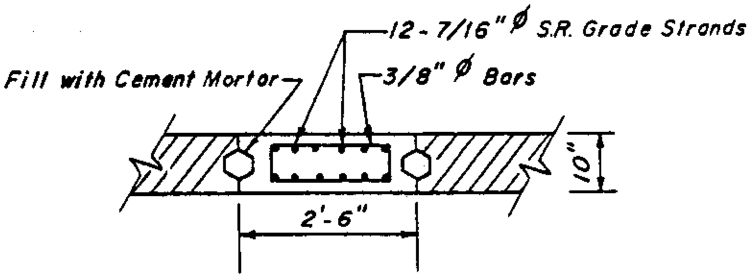
ENGINEERS–ARCHITECTS



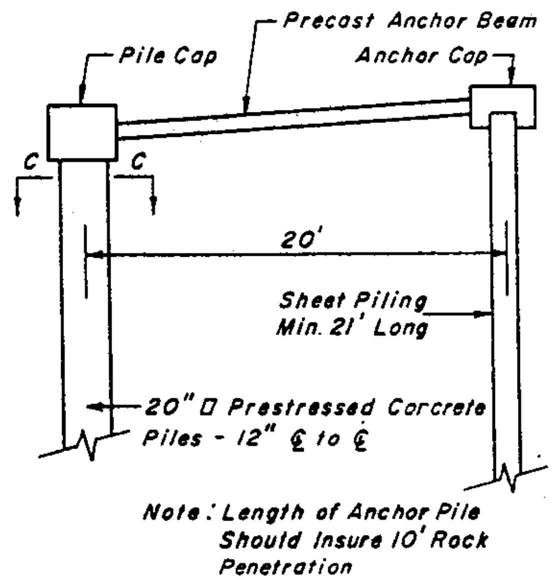
STEEL SHEET PILING



SECTION A-A SECTION B-B



SECTION C-C



PRESTRESSED CONCRETE SHEET PILING

DETAILS OF SHEET PILING BULKHEADS

DE LEUW, CATHER, & BRILL
ENGINEERS — ARCHITECTS